CAMBRIDGE ADVANCED NATIONALS

OCR
Oxford Cambridge and RSA

Sample assessment material

LEVEL 3 ALTERNATIVE ACADEMIC QUALIFICATION
CAMBRIDGE ADVANCED NATIONAL IN

HUMAN BIOLOGY

Certificate H049
Extended Certificate H149

For first teaching in 2025

F170: Fundamentals of human biology

Version 2.0 (June 2025)

Introduction

This is Sample Assessment Material (SAM) which has been produced for the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Certificate) and the OCR Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology (Extended Certificate).

The SAM is an example exam paper that we publish alongside a new specification to help illustrate its intended style and structure when a qualification is first launched. We wanted to share the story of our assessment approach with you so when you look through the paper you will find we have pointed out certain features and explained the decisions we have made.

Resources to help support in teaching different areas of content can be found on the OCR Level 3 Cambridge Advanced National in Human Biology webpage under Planning and teaching '.

Our exam papers are developed with accessibility in mind. The Understanding the assessment guide tells you a little more about the principles and rationale underpinning our approach for the qualifications. The 'Command Words' are in both the Understanding the Assessment guide and the specification. These tell you what we mean by each command word and how students should approach the question and understand its demand.

Appendix B of the specification: **Command Words**, gives detail about what is expected of each command word that will be included in exams and mark schemes. You can include teaching around the expectations of these as part of your teaching.

You said, we did

During the development of this qualification, we talked extensively with teachers, subject experts, higher education institutions and our senior assessment teams to influence its structure, content and assessment materials. We then shared our final materials with teachers to make sure that they met their needs.

You told us that you wanted individual exam questions to build up in parts, so we've included questions with sub-parts to incorporate this approach.

You also told us that questions that needed long responses in contexts that are unfamiliar to students are particularly challenging. We've focused on making our exams accessible by using contexts that will be familiar to students, keeping scenarios short and only including information that is needed to answer the questions.

You said that questions containing data or graphs for students to interpret were really appropriate in these assessments as it's so fundamental to the subject, so we've included a number of questions that require this.

You identified that the qualification and assessments need to appeal to a wide range of students and allow progression of subject knowledge and understanding from GCSE combined science qualifications. Higher Education Institutions also told us where there may be knowledge and skills gaps in undergraduate students progressing to their courses. We've developed our exams with effective progression from key stage 4 science qualifications, and to appropriate HEI courses, in mind.

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All students will sit the exam at the same time on the same day.

This exam will always be set and marked by us. Exams will be available in January and June each year. Students can resit this unit and the best result will be used to calculate the certification result.

Students must have a ruler that measures centimetres and millimetres for this exam. They can also use a scientific or graphical calculator if they wish.

If students require additional answer space, lined paper may be available at the end of the answer booklet in a live question paper. Remember the question number(s) must be clearly shown.

OCR
Oxford Cambridge and RSA

<<Date>> – <<Morning/Afternoon>>

Level 3 Alternative Academic Qualification Cambridge Advanced National in Human Biology

H049/H149 Unit F170: Fundamentals of human biology

Sample Assessment Material (SAM)

Time allowed: 1 hour 15 minutes
XXX/XXXX

You must have:
- a ruler (cm/mm)

You can use:
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | Candidate number

First name(s)

Last name

Date of birth (D D M M Y Y Y Y)

INSTRUCTIONS
- Use black ink.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- In the live exam there might be lined pages at the end of the question paper for you to use if you need extra space. Remember, you must clearly show the question numbers.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- This document consists of **16** pages.

ADVICE
- Read each question carefully before you start your answer.

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This unit is part of the Certificate and Extended Certificate qualifications.

The time allowed is designed to give students approximately one minute per mark plus reading time.

There are no sections in this exam and there are no optional questions.

The exam will always have 60 marks. There are no sections in this exam.

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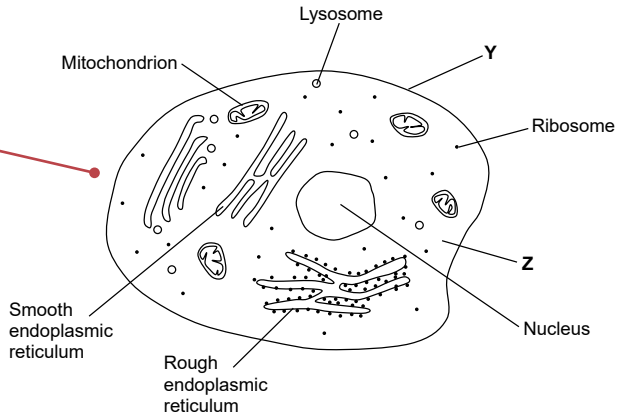
Diagrams will always be in grayscale.

In this exam there will be between 35-45 PO1 (show knowledge and understanding) marks. This proportion of PO1 marks helps to assess the fundamental knowledge needed for the course of study. Questions 1(a)(i) and (ii) are both examples of questions targeting PO1. Question 1(a)(i) requires students to identify parts of a cell from a diagram (due to cell diagrams being specifically required in the unit content), and Question 1(a)(ii) requires students to show their knowledge of the functions of a part of a cell.

Answer **all** the questions.

1 The diagram below shows a generalised model of a human cell. The diagram is **not** drawn to scale and two of the labels are incomplete.



(a)

(i) Identify Y and Z from the diagram.

Y .....

Z .....

[2]

(ii) Outline **two** ways the smooth endoplasmic reticulum supports the production of organelles in the cell.

1 .....

.....

2 .....

.....

[2]

All questions in this exam are mandatory. A range of question types are used, including:

- Forced choice/controlled response questions (also known as multiple choice questions (MCQs)). These are typically 1 mark but may have a maximum of 4 marks for a single MCQ.
- Short answer closed response questions. These questions sometimes might involve diagrams or calculations. They are typically worth 1 to 4 marks.
- Extended constructed response questions with points-based mark schemes. They are typically worth 1 to 4 marks.

These question types allow us to assess the following Performance Objectives:

- PO1 – Show knowledge and understanding
- PO2 – Apply knowledge and understanding

There will be no extended constructed response questions with levels of response mark schemes in this exam paper. The questions will sample content from across all Topic Areas. At least one question (or sub-part) will relate to each Topic Area. Sub-content topic areas will be sampled across exam papers, over time.

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(iii) Ribosomes are found freely throughout the human cell and are attached to the rough endoplasmic reticulum.

The diagram does **not** show the other location of ribosomes.

Which structure is also known to contain ribosomes?

Tick (✓) **one** box.

- Lysosome ☐
- Mitochondrion ☐
- Nucleus ☐
- Smooth endoplasmic reticulum ☐

[1]

(b) Many cells are highly specialised. These cells often originate from stem cells found in different locations in the adult human body. One location is in bone marrow.

(i) State **one other** location for stem cells in the adult human body.

..... **[1]**

(ii) Outline **two** advantages of using adult stem cells to produce new red blood cells in a laboratory.

1 .....

2 .....

[2]

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When a question needs an expected number of responses, the number needed will be given as a word in bold. We will also give the appropriate number of answer spaces to write in.

Students should use a tick (✓) in the box to show their response to multiple choice questions.

The number of marks for a question will always be given at the end of the question and will always be right aligned.

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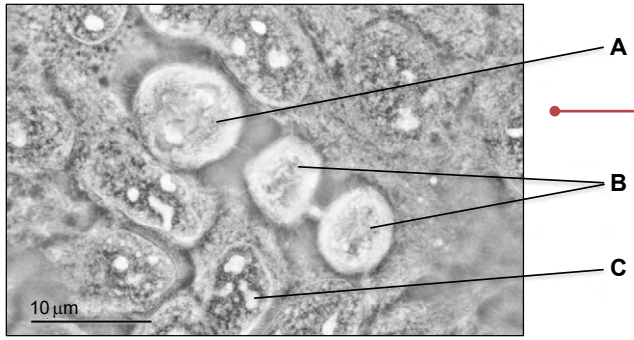
In this exam there will be between 15-25 PO2 (apply knowledge and understanding) marks. Questions targeting PO2 require students to apply their knowledge and understanding to human biology focused contexts. Question 2(a)(i) is an example of a question targeting PO2.

2 Human cancer cells divide rapidly by mitosis.

Cancer cells undergoing mitosis can be observed in a tissue sample using a light microscope.

The percentage of cancer cells dividing can be calculated over time to indicate the stage of cancer development.

The photomicrograph shows some cells undergoing mitosis within cancerous tissue.



Images will always be in grayscale.

(a)
(i) Using the photomicrograph, identify **one** advantage and **one** disadvantage of using a light microscope for this observation.

Q2(a)(i) is an **identify** question that assesses PO2. This question asks students to identify advantages and disadvantages of a light microscope using the photomicrograph. One mark is given for an advantage and another for a disadvantage. The mark scheme gives two example answers for both advantage and disadvantage, but we will credit any appropriate response to these two prompts.

Advantage .....

.....

Disadvantage .....

.....

[2]

(ii) The photomicrograph displays a bar line to represent 10 μm.

Calculate the magnification of the image using this information.

Use the equation: magnification = $\frac{\text{image size}}{\text{actual size}}$

In calculation questions, if the correct answer is present, we will award full marks and anything else in the answer space will be ignored. In the absence of the correct answer, we will award 1 mark for working. For example, in this case the presence of '25000μm ÷ 10μm' would receive one mark. Question 2(a)(i) is an example of a question targeting PO2.

Magnification = × ..... **[2]**

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Appendix B in the specification contains a glossary of Command Words which could be used in this exam. The glossary tells you what we mean by each command word.

(b) Identify the stages of mitosis shown at **A** and **B** in the photomicrograph.

Explain **one** reason for each choice.

Stage of mitosis at **A** .....

Explanation .....

.....

Stage of mitosis at **B** .....

Explanation .....

.....

[4]

This question type awards one mark per factor. This is signified by the spaces provided for students to write in.

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This MCQ is worth two marks. This is indicated by the emboldened word in the question and the number of marks shown at the end. MCQs might target either PO1 or PO2 marks.

3 An athlete has broken the radius bone in their arm.

Surgery will be required to hold the two parts of the bone together.

(a)

(i) The bone will reform as different components migrate across the adjacent surfaces between the two parts.

Which **two** components must migrate across the adjacent surfaces?

Tick (✓) **two** boxes.

If more than two boxes are ticked, zero marks are awarded.

- Erythrocytes ☐
- Fibrocytes ☐
- Hepatocytes ☐
- Muscle cells ☐
- Osteocytes ☐

[2]

(ii) Blood vessels grow between the two parts of the damaged radius bone to deliver essential molecules and ions needed to form new bone tissue.

Complete the sentences.

The blood supply delivers oxygen needed to carry out aerobic respiration.

The reforming bone tissue also needs …… ions to form the matrix.

Bone growth is energy demanding. The blood supply delivers …… molecules as an energy source.

Where a student's response completes a sentence or statement, it will always be shown like this. Students could also be asked to complete a table or diagram.

[2]

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Q4(a)(i) is a question which assesses PO1. Three marks are awarded for three correct answers.

4 A 6-year-old child has a hole in the septum of their heart between the two ventricles.

This condition is known as a ventricular septal defect (VSD).

Where context is given, it will be kept as short as possible and will only include information needed for the questions.

(a)

(i) The VSD can be diagnosed by observing a number of symptoms.

Three different physiological tools can be used to aid this diagnosis.

Complete the table to match the physiological tool used to show each of the symptoms of the VSD.

Symptom of the VSD	Physiological tool
Abnormal heartbeat	.....
Hole in the septum between the ventricles of the heart	.....
Rapid breathing	.....

[3]

(ii) Outline **one** potential impact of having a ventral septal defect to health.

..... **[1]**

(iii) Identify what will happen to the child's pulmonary ventilation rate (PVR) if their breathing rate increases.

..... **[1]**

Q4(a)(iii) requires the student to identify what will happen to a child's pulmonary ventilation rate (PVR) in context. This is an example of a PO2 question.

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Q4(b)(i) assesses PO1 by asking students to suggest two improvements to the method instructions given to patients using a peak flow meter.

One mark is given for each **improvement**. One mark is given for an **explanation** for that improvement.

Where a response relates to a response given in another question, this will be clearly indicated.

Q4(b)(ii) assesses PO1 by asking students which pulmonary resistance value should be written down in a patient's log chart after following the steps specified in question 4(b)(i).

(b)

(i) If not treated, a VSD may lead to a higher pressure of blood delivered at the lungs. This results in a condition called pulmonary resistance.

Pulmonary resistance can be measured using a peak flow meter.

The following instructions were provided to patients on a leaflet with the meter.

- Move the marker to the bottom of the numbered scale.
- Take a deep breath to fill your lungs.
- Blow out as hard as you can in a single blow.
- Write down the number you get.
- Repeat the set of steps 2 more times.

Explain **two** improvements that are necessary to ensure an accurate reading is taken.

Improvement 1 .....

Explanation .....

.....

Improvement 2 .....

Explanation .....

..... **[4]**

(ii) The steps taken in question **4(b)(i)** will give three pulmonary resistance values.

Which of the three values should be written down in the patient's log chart?

..... **[1]**

This question is worth 4 marks. Up to two marks for each valid improvement and up to two marks for each valid explanation.

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Q5(a) assesses PO1 by asking students to describe how hormones control different parts of the body.

5

(a) Hormones are produced in endocrine glands.

Describe how hormones control different parts of the body.

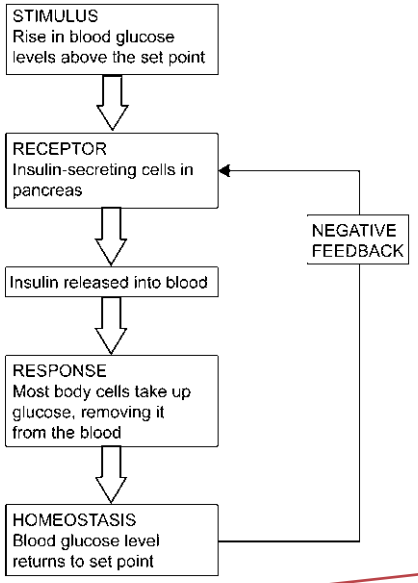
.....

.....

..... **[2]**

One mark is awarded for each correct answer.

(b) The homeostasis model summarises the steps involved in the regulation of glucose.


STIMULUS
Rise in blood glucose levels above the set point
RECEPTOR
Insulin-secreting cells in pancreas
NEGATIVE FEEDBACK
Insulin released into blood
RESPONSE
Most body cells take up glucose, removing it from the blood
HOMEOSTASIS
Blood glucose level returns to set point

(i) Using the model above, explain how negative feedback affects the release of insulin from the insulin-secreting cells.

.....

.....

.....

..... **[2]**

Explain is a command word which can assess either PO1 or PO2, depending on whether a question is set in context or not. Where a question asks students to **explain**, they must show (PO1) or apply (PO2) their knowledge and understanding. It is not enough to recall or apply knowledge alone.

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This outline question assesses PO1 – knowledge and understanding.

This question assesses maths skills. It is PO2 as students need to apply their knowledge and understanding to the context to be able to answer it.

(ii) Outline why negative feedback is an essential part of glucose regulation.

.....

..... **[1]**

(c)
(i) The table below shows the classification of non-diabetic, pre-diabetic and type 2 diabetic patients based on their blood glucose levels.

Classification	Blood glucose levels 2 hours after food (mg / dl of blood)	Blood glucose levels 12 hours after food (mg / dl of blood)
Non-diabetic	70-99	<140
Pre-diabetic	100-125	140-199
Type 2 diabetes	126	200

A patient has their blood glucose measurement taken. Their blood glucose levels 2 hours after food is 105 (mg / dl of blood).

Calculate the percentage by which this patient's blood glucose concentration 2 hours after food is higher than the upper limit for normal concentration.

Give your answer to an appropriate number of significant figures.

..... **[2]**

The amount of marks available indicates the steps required.

Full marks will be given for a correct answer, with or without working out.

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11

(ii) Research has led to the production of an automated tool, commonly called the artificial pancreas, to regulate **type 1** diabetes. The tool uses a hybrid closed loop system, as shown in the image.

- A sensor is attached to the body of the patient to monitor blood glucose levels.
- The 'set point' for the patient is programmed into a body-worn insulin pump.
- The sensor transmits data to the pump.
- The data is used to calculate how much insulin is needed by the patient.
- The pump is charged by a battery cell and delivers insulin into the patient's blood.

Explain **one** advantage of using an artificial pancreas.

.....

.....

..... **[2]**

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Turn over

Key words will be in bold.

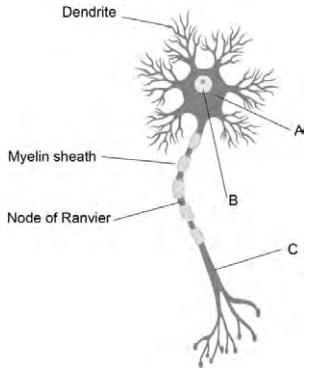
This **explain** question assesses PO2. Students will not have studied about an artificial pancreas so need to use the stimulus to identify an advantage and then explain why it is an advantage.

The number of lines given for a question indicate the approximate length of the answer required.

6 A trainee doctor is studying multiple sclerosis (MS).

The trainee is already aware that this condition involves a change in the structure and function of neurons in the body.

(a) The course tutor shows the trainee a diagram of a motor neuron affected by MS.



(i) Identify structures **A**, **B** and **C** in the diagram.

A .....

B .....

C .....

[3]

(ii) Outline the changes to the myelin sheath causing MS.

.....

.....

..... **[2]**

(iii) State the impact of the changes to the myelin sheath on the transmission of impulses along the motor neuron.

.....

..... **[1]**

(b) The trainee is exploring the overall effect of MS on the spinal reflex arc.

State **one other** type of neuron commonly found in the spinal reflex arc, **not** including the motor neuron.

..... **[1]**

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Q6(a)(i) is an **identify** question that assesses PO2, asking students to name features from the stimulus. One mark is given for each correct answer.

Q6(a)(ii) assesses PO1 by asking students to show their knowledge and understanding of taught content in order to give an account of the changes to the myelin sheath.

This **state** question assesses PO1 by asking students to give a short, factual answer. Any creditable content will receive a mark.

Students will not get a mark for giving **motor neuron** as their answer.

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7 A team of research scientists are culturing bacteria extracted from the large intestine of a patient.

(a) Explain **two** roles of a Bunsen burner when culturing bacteria.

1 .....

.....

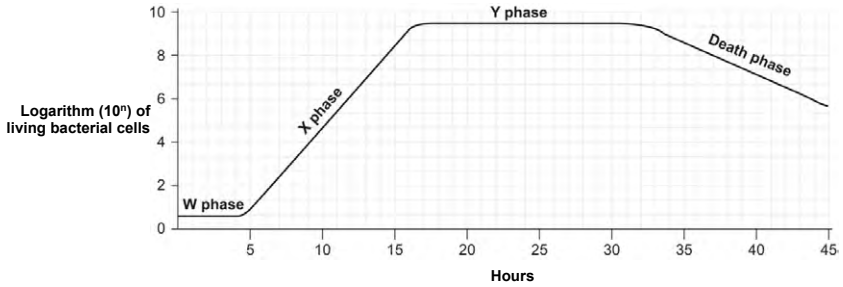
2 .....

.....

[2]

(b) A specific type of bacteria in the sample is cultured in a container of nutrient broth. Changes in the bacteria population are recorded over a period of 45 hours.

The results of the study are shown in the graph.



(i) What is the increase in logarithm (10^n) of living bacterial cells recorded between phases **W** and **Y**?

Increase in logarithm (10^n) of living cells = ... **[1]**

(ii) State the names of the **W** phase and **Y** phase.

W phase .....

Y phase .....

[2]

(iii) Under optimum conditions in the phase labelled **X** on the diagram, bacteria in the container reproduce rapidly by binary fission.

Calculate the rate of change during the **X** phase.

rate of change = ... **[2]**

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Turn over

Where a question asks for a specific number of points, we will always put numbers or response headings against answer lines to show where students should write each point of their response.

Q7(b)(ii) is a short answer, closed response question. This assesses PO1 by asking students to give the names of each phase.

Q7(b)(i) assesses PO2 by asking students to read the graph to state the increase in logarithm of living bacterial cells. A tolerance of +/-0.5 is allowed.

Short answer questions with calculation/working will be indicated by the command word **calculate**. These will target PO2 as they will be set in context. A numerical value should be given. If the correct answer is present, we will award full marks and anything else that is written in the answer space will be ignored. In the absence of the correct answer, one mark is given for (9.33-0.67)/(16-5) **or** 8.66/11 as correct working out

(c)

(i) The research scientists have shown that many of the bacteria found in the large intestine are beneficial to human health and wellbeing.

The beneficial bacteria can produce antimicrobial peptides (AMP) or proteins, which disrupt the cell walls of disease-causing bacteria.

Explain how bacteria in the biome carry out their beneficial activities.

.....

.....

.....

.....

.....

..... **[3]**

Q7(c)(ii) assesses PO1 by asking students to give a safety factor to be considered when bacterial rectal implants are used.

(ii) The research scientists use the latest technologies to generate products for therapeutic use, including bacterial rectal implants.

Bacterial rectal implants derived from donors must be safe to use.

State **one** factor to be considered to make sure that the implants are safe to use.

..... **[1]**

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Question 8(a) is a short answer, closed response question that assesses PO1 by asking students to give the function of hyphae.

Question 8(b) is a short answer, closed response question assessing PO1. Students need to outline how parasitic fungi infect body tissues, with two marks available for two creditworthy points.

8 Fungi live in many different locations, including inside the human body.

(a) A number of fungal species form branching hyphae, called a mycelium.

The septum in the fungal hypha contains tiny holes or perforations.

What is the function of hyphae?

..... **[1]**

(b) Outline how parasitic fungi, such as *Aspergillus*, infect body tissues.

.....

..... **[2]**

END OF QUESTION PAPER

This tells students there are no more questions to answer.

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